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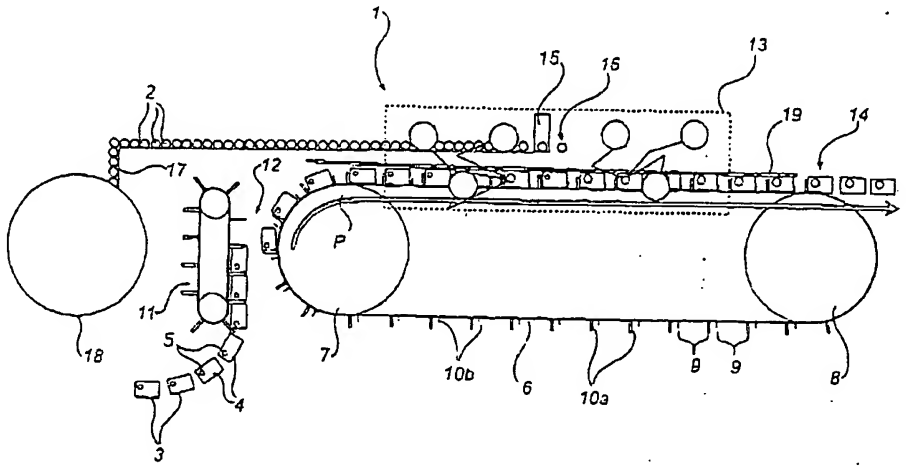

(57) Abstract: A system (14) and a method for applying opening devices (2) onto packages (3) of pourable food products are provided. The system comprises a package conveyor (6) for feeding the packages along a predetermined path (P) and an application apparatus (13) for applying the opening devices onto the packages on the package conveyor. The application apparatus comprises an optical detection unit (30) for detecting an application point on one of the packages (20) on the package conveyor. The application apparatus further comprises a pick and place unit (36) for receiving application information regarding the detected application point from the optical detection unit, picking one of the opening devices and placing it onto said one of the packages on the package conveyor by means of the application information.

WO 03/057460 A1

SYSTEM AND METHOD FOR APPLYING OPENING DEVICES ONTO PACKAGES

Technical Field

The present invention relates to a system and a method for applying opening devices onto packages of pourable food products, said system comprising a package conveyor for feeding said packages along a predetermined path and an application apparatus for applying said opening devices onto said packages on said package conveyor.

Background Art

As is known, many pourable food products, such as fruit juice, UHT (ultra-high-temperature processed) milk, wine, tomato sauce, etc., are sold in packages made of sterilized packaging material.

A typical example of such a package is the parallelepiped-shaped package for liquid or pourable food products known as Tetra Brik Aseptic (registered trademark), which is formed by folding and sealing a web of laminated packaging material. The packaging material has a multilayer structure comprising a layer of fibrous material, e.g. paper, covered on both sides with layers of heat-seal plastic material, e.g. polyethylene, and, in the case of antiseptic packages for long-storage products, such as UHT milk, also comprising a layer of oxygen-barrier material defined, for example, by an aluminium film, which is superimposed on a layer of heat-seal plastic material and is in turn covered with another layer of heat-seal plastic material eventually defining the inner face of the package contacting the food product. As is known, such packages are made on fully automatic packaging machines, in which a continuous tube is formed from the web-fed packaging material; the web of packaging material is sterilized in the packaging machine itself, e.g. by applying a chemical sterilizing agent, such as a hydrogen peroxide solution, which, after sterilization,

is removed, e.g. vaporized by heating, from the surface of the packaging material; and the web of packaging material so sterilized is maintained in a closed sterile environment, and is folded and sealed longitudinally to form a vertical tube. Of course it is possible to use other methods for sterilizing the packaging material.

The tube is filled with the sterilized or sterile-processed food product, and is sealed and cut at equally spaced cross sections to form pillow packs, which are then folded mechanically to form the finished, e.g. substantially parallelepiped-shaped, packages.

Alternatively, the packaging material may be cut into blanks, which are formed into packages on forming mandrels, and the resulting packages are filled with the food product and sealed. One example of such a package is the so-called "gable-top" package commonly known by the trade name Tetra Rex (registered trademark).

Another example of a package for pourable food products is the parallelepiped-shaped package known as Tetra Brik (registered trademark). The main difference between Tetra Brik and Tetra Brik Aseptic is that Tetra Brik does not comprise an oxygen-barrier layer since it is mainly used for "ordinary" pasteurised milk products.

Once formed, packages of the above type may undergo further processing, such as the application of a closable opening device constituting the pouring part of a package.

The most commonly used opening device comprises a frame defining an opening and fitted about a pierceable or removable portion of the top wall of the package; and a cap hinged or screwed to the frame and which can be removed to open the package. Other, e.g. slidable, opening devices are also known to be used.

The pierceable portion of the package may be defined, for example, by a so-called "prelaminated" hole, i.e. a hole formed in the fibrous layer of the packaging material before the fibrous layer is joined to the bar-

rier layer, which is thus whole and closes the hole to ensure hermetic, aseptic sealing, while at the same time being easily pierced.

The application of an opening device onto a package calls for extremely accurate positioning of the opening device with respect to the prelaminated hole. Applying the opening device in a wrong position may result in various problems, such as poor adhesion of the opening device onto the package, difficulties in opening the package, product leakage, or splashing when the product is poured out of the package.

In the case of antiseptic packaging machines, the opening devices are normally fitted continuously straight onto the formed packages on on-line application units downstream from the packaging machine. The application is mechanical, i.e. the packages abut against some kind of holding means and the edges of the packages are used to position opening devices on them, the application position on each package being at a predetermined distance from its edges. This means that the opening devices will be applied at the same spot on every package. For several reasons, the packages to be provided with opening devices are not identical. This means that the distance from the prelaminated hole on a package to its edges differs from package to package. Thus, on many packages the opening devices will not be applied precisely about the prelaminated hole, causing malfunctioning of the package.

EP 0 842 041 discloses a method and device for bonding pouring spouts to flat-topped parallelepipedical cartons filled with free-flowing products. In EP 0 842 041, separated cartons on a conveyor belt are fed horizontally. Above the conveyor belt, a suspension chain is arranged, said chain being provided with a number of pouring spouts carriers for the bounding of the pouring spouts to the cartons, the distance between said carriers being equal to the distance between said separated cartons on said conveyor belt. A detector is provided to sense the

presence of a pouring spout in a pouring spout carrier. If the detector senses such a presence, a package is loaded onto the conveyor belt and the pouring spout is applied with adhesive and bound to the package. Even in this case the application is mechanical which can cause the pouring spouts to be inaccurately bounded to the cartons since the bounding occurs in the same position relative the carriers on every carton, independently of the correct application positions.

Summary of the Invention

An object of the present invention is to provide a system and a method for applying opening devices onto packages of pourable food products, which system and method eliminate the aforementioned problems concerned with prior art. The basic concept of the invention is to use optical detection to locate where on a package an opening device is to be applied, that is to locate an application point on the package. The invention thus enables extremely accurate positioning of the opening device onto the package independently of its shape, as long as the application point is visible. Even if the package for some reason has a shape deviating from the ideal shape, it will be provided with the opening device in the correct position since no part of the package is used as a reference for the provision.

The system and the method for achieving the object above are defined in the appended claims and discussed below.

The system according to the present invention has a package conveyor for feeding the packages successively along a predetermined path. Along this path, the packages are being subjected to different operations. The system further has an application apparatus for continuously applying the opening devices onto the packages. The application apparatus is preferably located adjacent to the package conveyor to enable the application of

the opening devices on the packages when they pass by on the package conveyor.

To detect an application point on one of the packages, the application apparatus has an optical detection unit. By means of this detection unit the application point can be read reliably. Since the appearance of the package does not affect the detection of the application point, there will be no interference from disturbing factors, such as e.g. a potential deformation of the package. This means that even a deformed package, having other dimensions than the ideal package, will be provided with an opening device exactly on top of the application point. If optical detection had not been used, that is if instead mechanical clamping had been used, the opening device would have been misplaced with respect to the application point. Thus, the optical detection also allows for application of opening devices on packages of different sizes, since the application point is not estimated from the dimensions of the package.

The application apparatus further has a pick and place unit for the actual picking and placing of the opening devices. The pick and place unit is arranged to receive application information regarding the detected application point on a package from the optical detection unit. It is further arranged to pick one of the opening devices and placing it onto the package by means of the application information. The application information for one particular package is unique and depends on the appearance of the it.

The application point on a package is preferably defined by a prelaminated hole on the package. This means that the opening device, for a correct application, is to be placed over the prelaminated hole to enclose and cover it.

The optical detection unit advantageously has a camera for recording an image of a package, which image contains the application point of the package. This image

can then be used to obtain the unique application information for the package. The optical detection unit also has processing means for producing the application information. This is done by comparing the recorded image with a reference image containing a reference system, and then obtaining a location of the application point with respect to the reference system.

The reference system preferably includes a predetermined, memorized, ideal application point for one type of package. The ideal application point is defined by the location of the application point on a perfect package. By a perfect package means, a package having the desired dimensions, being undeformed and having the application point located optimally with respect to the function of the package.

Alternatively, the reference system includes a predetermined, memorized, ideal location of the application point in relation to a mark, which mark is fixed with respect to the package conveyor. Also in this case the ideal location corresponds to the application point on a perfect package.

The application information preferably contains a unique movement pattern for the pick and place unit for placing the opening device onto the package. Thus, the pick and place unit picks the opening device, receives the movement pattern and moves according to this pattern to place the opening device onto the package.

The optical detection unit is with advantage arranged integral with the pick and place unit. The detection of the application point on the package and the application of the opening device on it, can then be done continuously.

As an alternative, the optical detection unit can be arranged adjacent to the package conveyor at a distance from the pick and place unit. In this case, the speed of the package conveyor must be known so that the location of the application point on the package, at a certain

time, can be calculated to obtain the unique application information for that package.

The pick and place unit has at least one robot with at least one robot arm. However, the pick and place unit advantageously has at least one robot with three robot arms. This robot is able to operate in three dimensions so as to allow full movement ability of the pick and place unit.

Preferably, the application apparatus further includes a gluing unit for applying glue onto the opening devices before they are picked by the pick and place unit, to make them adhere onto the packages.

The system further has a supply station for feeding the packages to the package conveyor. In the supply station, packages from the filling machine are prearranged to have a certain mutual distance when they are automatically fed, one by one, from the supply station to the package conveyor.

Preferably, the system further has a package support rail for supporting the packages during the application of the opening devices. This is done by securing the packages between the support rail and the package conveyor. The package support rail is preferably adjustable to allow the distance between itself and the package conveyor to be varied, so that opening devices can be applied to packages of different sizes.

A number of separated guiding devices for guiding the packages are preferably comprised in the system. The guiding devices are then fixed to, and move with, the package conveyor so as to feed the packages along the above mentioned predetermined path. Besides supporting and carrying the packages, the guiding devices also provide for the packages being separated by an appropriate distance for the operations to be performed on the packages on the package conveyor. The distance between the guiding devices is preferably adjustable to fit different package sizes.

Each of the guiding devices advantageously includes at least one carrier finger for the supporting and conveying of the packages. The carrier fingers preferably have a shape, and are fixed to the package conveyor in a way, that is suitable for the appearance of the packages. For example, if the packages are parallelepiped-shaped, the carrier fingers can simply be rectangular plates projecting radially from the package conveyor, with the packages abutting against the plates by one of the walls.

Finally, the system further includes a feeding apparatus for feeding the opening devices to the application apparatus, or more particularly, to the gluing unit, whereupon they are picked by the pick and place unit.

The method according to the present invention comprises the steps of feeding the packages along a predetermined path by a package conveyor and applying the opening devices onto the packages on the package conveyor. The method further includes the steps of optically detecting an application point on a package on the package conveyor; producing, from the optically detected application point on the package, application information for controlling a pick and place unit; and picking an opening device and placing it onto the package on the package conveyor by means of the pick and place unit and in accordance with the application information.

Brief Description of the Drawings

Figure 1 shows a system according to the present invention.

Figure 2 is a top plan view of a package.

Figure 3 is a top plan view of a package according to an alternative embodiment of the invention.

Figure 4 is block diagram describing the application apparatus in a system according to the present invention.

Figure 5 shows the pick and place unit in the application apparatus in figure 4.

Figure 6 is flowchart illustrating the method according to the present invention.

Detailed Description of Embodiments

Figure 1 is a schematic plan view of a system 1 for applying opening devices 2 onto packages 3 of pourable food products.

The packages 3 are made in a packaging machine (not shown) from a web of sheet packaging material comprising a layer of paper material covered on both sides with layers of heat-seal plastic material, e.g. polyethylene, and optionally a layer of barrier material, e.g. aluminium, located on the inside of the paper material layer and in turn covered on the inside with another layer of plastic material.

A top face 4 of each package 3, which, in the illustrated example, are substantially parallelepiped-shaped, has a pierceable portion 5 conveniently defined by a so-called "prelaminated" hole, i.e. a hole formed in the paper layer of the packaging material before the paper layer is joined to the barrier layer, which thus closes the hole to ensure hermetic, aseptic sealing, while at the same time being easily pierced.

The system 1 comprises a package conveyor 6 moving at a constant speed along a path defined by two drive means 7 and 8, respectively. The package conveyor 6 supports a number of guiding devices 9 for guiding packages 3, wherein the guiding devices are fixed in equally spaced manner to, and project radially from, the package conveyor 6. Each of the guiding devices 9 includes two carrier fingers 10a and 10b, respectively, for supporting and conveying one package, the package abutting against the carrier fingers 10a-b by two opposite walls and against the package conveyor 6 by an intermediate wall, the distance between said carrier fingers thus being essentially equal to the distance between said opposite walls.

The guiding devices 9 receive the packages 3 from an input conveyor 11, one package being fed into each of the guiding devices. The input conveyor 11 is located adja-

cent to the package conveyor 6 and tangent to the same at a supply station 12. It conveys the packages 3 from the filling machine (not shown) in equally spaced manner and at a constant speed equal to the linear speed of the guiding devices 9. Rotating together with the package conveyor 6, the guiding devices 9 feed the packages 3 along a path P through an application apparatus 13 for applying the opening devices 2 onto the packages 3, the application apparatus 13 being located adjacent to the package conveyor 6. The path P begins with the supply station 12 and ends with an unloading station 14 where the packages 3 are removed from the package conveyor 6.

The application apparatus 13 comprises a gluing unit 15 for applying glue onto the opening devices 2 and a picking unit 16 to which the opening devices are fed after the glue application.

The system 1 includes a feeding apparatus 17 for feeding the opening devices 2 from a sorter 18 to the gluing unit 15 and further onto the picking unit 16 in the application apparatus 13. The system 1 further includes a package rail support 19 for supporting the packages 3 during the application of the opening devices 2. The package support rail 19 is arranged essentially parallel to the package conveyor 6 along the horizontal part of the path P and secures the packages 3 between itself and the package conveyor 6. To permit application of opening devices onto packages of various sizes, the package support rail 19 is adjustable in height, i.e. the uniform distance from the package support rail 19 to the package conveyor 6 is variable.

Figure 2 and 3 are two top plan views of a package 20 showing a pierceable portion in shape of a prelaminated hole 21. The centre 22 of the hole is used to define the location of the same. The location of the prelaminated hole is not the same on every package. The dashed circle 23 in the figures represents the ideal location

of a prelaminated hole, i.e. the location of the prelaminated hole on a perfect package.

In figure 2 the ideal location of the prelaminated hole, or more particularly the centre 24 of it, is used as a reference system to express the location of the centre 22 of the actual prelaminated hole 21 on the package 20. The deviation of the prelaminated hole 21 from the ideal location 23 (strongly exaggerated to make it more clear) is represented by the arrow 25 between the centre 24 and the centre 22. The arrow 25 can be divided into a horizontal component 26 and a vertical component 27 describing the deviation of the prelaminated hole 21 in horizontal and vertical directions, respectively.

Figure 4 is a block diagram illustrating the construction of the application apparatus 13. In addition to the above discussed gluing unit 15 and the picking unit 16, the application apparatus 13 comprises an optical detection unit 30 for detecting the centre 22 of the prelaminated hole 21 on each of the packages 3.

The optical detection unit 30 in turn comprises a sensor 31 for generating a signal enabling a camera 32, e.g. one of CCD-type, for recording an image of the top of each of the packages 3, the image showing the prelaminated hole and its centre. The optical detection unit 30 further comprises a memory 33 for storing a reference image with a reference system represented by the ideal location discussed above, and processing means 34 arranged to compare the recorded image with the reference image, more particularly, the prelaminated hole in the recorded image with the reference system. The result of this comparison, i.e. the deviation of the prelaminated hole from the ideal location in horizontal and vertical directions, respectively, is thereafter used to produce application information needed for the application of the opening devices 2 onto the packages 3. The optical detection unit 30 also comprises transmitting means 35 for

transmitting this application information regarding the detected prelaminated hole.

The application apparatus 13 further comprises a pick and place unit 36 for picking the opening devices 2 from the picking unit 16 and placing them onto the packages 3.

The pick and place unit 36 in turn comprises receiving means 37 for receiving said transmitted application information and a robot 38. The application information contains a movement pattern for the pick and place unit 36 describing the movement for the same from a reference position to place one opening device onto one package very accurately on top of its prelaminated hole.

In the preferred embodiment the robot 38, described further in figure 5, is a picking robot, type IRB 340, commercially available from ABB Flexible Automation AB, Västerås Sweden. It has three robot arms 39a-c being joined together at one end at 40, the robot 38 being able to operate in three dimensions. The robot 38 is at 40 provided with jaws 41 for picking and placing the opening devices 2 onto the packages 3, the jaws 41 closing when picking, and opening when placing, an opening device.

The optical detection unit 30 is preferably arranged integral with the pick and place unit 36, the camera 32 being arranged adjacent to the jaws 41.

Figure 6 is a flowchart illustrating the method according to the present invention. Every box in the flowchart corresponds to one step in the method. The operations are obviously performed cyclically with a period equal to the time required by the package conveyor 6 to move the distance between two subsequent packages 3. First there are two branches in the flowchart which later merge into one. The opening devices 2 are sorted in the sorter 18 (step 42), fed from the sorter 18 to the gluing unit 15 by the feeding apparatus 17 where they are provided with glue (step 43) and further fed to the picking unit 16 (step 44). Simultaneously, the packages 3 from

the packaging machine are being loaded onto the input conveyor 11 (step 45) and then supplied onto the package conveyor 6 feeding them to the application apparatus 13 (step 46). One of the glued opening devices is picked by the pick and place unit 36 (step 47) from the picking unit 16. To avoid acquiring and processing an excessive amount of data, the sensor 31 generates a trigger pulse to enable the camera 32 (step 48). The camera then records an image of the top of one of packages 3, said image showing the prelaminated hole and its centre (step 49). In the memory 33, a reference image, containing the reference system discussed above, is stored. On the basis of conventional image processing, the deviation of the prelaminated hole with respect to its ideal location is determined and a movement pattern for the robot 38 is produced (step 50) based on said deviation. The movement pattern is transmitted from the optical detection unit 30 and received by the pick and place unit 36 (step 51). The pick and place unit 36 follows the movement pattern from a reference position and places the opening device accurately on top of the prelaminated hole of the package (step 52). Finally the packages provided with opening devices are unloaded at the unloading station 14 (step 53).

As an alternative to the above, the reference system required for the application may be implemented by a mark 29 on a guiding device 28. In figure 3 the package 20 is shown together with a part of the guiding device 28, said guiding device being provided with the mark 29. The mark 29 and the ideal location of the prelaminated hole 23 constitute the reference system in this alternative embodiment. On a perfect package, the distance between the mark 29 and the ideal location of the prelaminated hole 23, or more particularly the centre 24 of it, is x_0 and y_0 in horizontal and vertical directions, respectively. In the figure the distance between the mark 29 and the location of the centre 22 of the actual prelaminated hole

21 is x_1 and y_1 in horizontal and vertical directions, respectively, the expressions $|x_0-x_1|$ and $|y_0-y_1|$ describing the deviation of the prelaminated hole 21 from the ideal location 23 in respective directions.

The above described examples shall only be seen as examples. A person skilled in the art realizes that the embodiments discussed can be varied in a number of ways without deviating from the inventive conception.

As an example, the opening devices do not have to be glued onto the packages. Alternatively, the opening devices can be heated and then sealed onto the packages.

The pick and place unit can comprise more than one robot, allowing more than one application at a time, speeding up the production.

The optical detection unit and the pick and place unit do not have to be arranged integral with each other. According to an alternative embodiment the optical detection unit is arranged adjacent to the package conveyor at a distance from the pick and place unit. If the speed of the package conveyor is known, the location of the centre of the prelaminated hole on a package at a certain time can be determined and the application information can be produced and transmitted to the pick and place unit.

CLAIMS

1. A system (1) for applying opening devices (2) onto packages (3) of pourable food products, said system comprising a package conveyor (6) for feeding said packages along a predetermined path (P) and an application apparatus (13) for applying said opening devices onto said packages on said package conveyor, c h a r a c t e r i s e d in that said application apparatus comprises an optical detection unit (30) for detecting an application point on one of said packages (20) on said package conveyor and a pick and place unit (36) for receiving application information regarding said detected application point from said optical detection unit, picking one of said opening devices and placing it onto said one of said packages on said package conveyor by means of said application information.

2. A system (1) as claimed in claim 1, c h a r a c t e r i s e d in that said application point is defined by a prelaminated hole (21) on said one of said packages (20).

3. A system (1) as claimed in claims 1 or 2, c h a r a c t e r i s e d in that said optical detection unit (30) comprises a camera (32) for recording an image of said one of said packages (20), wherein said image contains said application point.

4. A system (1) as claimed in claim 3, c h a r a c t e r i s e d in that said optical detection unit (30) further comprises processing means (34) for producing said application information by comparing said image with a reference image containing a reference system, and obtaining a location of said application point with respect to said reference system.

5. A system (1) as claimed in claim 4, c h a r a c t e r i s e d in that said reference system includes an

ideal location of the application point (23) corresponding to the application point on a perfect package.

6. A system (1) as claimed in claim 4, c h a r a c t e r i s e d in that said reference system includes an ideal location of the application point (23) in relation to a mark (29) being fixed with respect to said package conveyor (6), said ideal location corresponding to the application point on a perfect package.

7. A system (1) as in any one of the foregoing claims, c h a r a c t e r i s e d in that said application information contains a movement pattern for said pick and place unit (36) for placing said one of said opening devices onto said one of said packages (20).

8. A system (1) as claimed in any one of the foregoing claims, c h a r a c t e r i s e d in that said optical detection unit (30) is arranged integral with said pick and place unit (36).

9. A system (1) as claimed in any one of claims 1-7, c h a r a c t e r i s e d in that said optical detection unit (30) is arranged adjacent to said package conveyor (6) at a distance from said pick and place unit (36).

10. A system (1) as claimed in any one of the foregoing claims, c h a r a c t e r i s e d in that said pick and place unit (36) comprises at least one robot (38) with at least one robot arm (39a-c).

11. A system (1) as claimed in any one of claims 1-9, c h a r a c t e r i s e d in that said pick and place unit (36) comprises at least one robot (38) with three robot arms (39a-c), said at least one robot being able to operate in three dimensions.

12. A system (1) as claimed in any one of the foregoing claims, c h a r a c t e r i s e d in that said application apparatus (13) further comprises a gluing unit (15) for applying glue onto said opening devices (2) before picking.

13. A system (1) as claimed in any one of the foregoing claims, c h a r a c t e r i s e d in that it further

comprises a supply station (12) for feeding said packages (3) to said package conveyor (6).

14. A system (1) as claimed in any one of the foregoing claims, characterised in that it further comprises a package support rail (19) for supporting said packages (3) during the application of said opening devices (2) by securing said packages between said support rail and said package conveyor (6).

15. A system (1) as claimed in claim 14, characterised in that said package support rail (19) is adjustable to permit application of opening devices (2) onto packages (3) of various sizes.

16. A system (1) as claimed in any one of the foregoing claims, characterised in that it further comprises a number of separated guiding devices (9) for guiding said packages (3), said guiding devices being fixed to and movable with said package conveyor (6) so as to feed said packages along said predetermined path (P).

17. A system (1) as claimed in claim 16, characterised in that said guiding devices (9) each comprises at least one carrier finger (10) for supporting and conveying said packages (3).

18. A system (1) as claimed in any one of the foregoing claims, characterised in that it further comprises a feeding apparatus (17) for feeding said opening devices (2) to said application apparatus (13).

19. A system (1) as claimed in claim 12, characterised in that it further comprises a feeding apparatus (17) for feeding said opening (2) devices to said gluing unit (15), whereupon said opening devices are being picked by said pick and place unit (36).

20. A method for applying opening devices (2) onto packages (3) of pourable food products, comprising the steps of feeding said packages along a predetermined path (P) by a package conveyor (6) and applying said opening devices onto said packages on said package conveyor,

characterised in that it further comprises the steps of optically detecting an application point on one of said packages (20) on said package conveyor; producing, from said optically detected application point, application information for controlling a pick and place unit (36); and picking one of said opening devices and placing it onto said one of said packages on said package conveyor by means of said pick and place unit and in accordance with said application information.

21. A method as claimed in claim 20, characterised in that said application point is defined by a prelaminated hole (21) on said one of said packages (20).

22. A method as claimed in claim 20 or 21, characterised in that it further comprises the step of recording an image of said one of said packages (20), wherein said image contains said application point.

23. A method as claimed in claim 22, characterised in that said application information is produced by comparing said image with a reference image containing a reference system, and obtaining a location of said application point with respect to said reference system.

24. A method as claimed in claim 23, characterised in that said reference system includes an ideal location of the application point (23) corresponding to the application point on a perfect package.

25. A method as claimed in claim 23, characterised in that said reference system includes an ideal location of the application point (23) in relation to a mark (29) being fixed with respect to said package conveyor (6), said ideal location corresponding to the application point on a perfect package.

26. A method as claimed in any one of claims 20-25, characterised in that said application information contains a movement pattern for said pick and place

unit (36) for placing said one of said opening devices onto said one of said packages (20).

27. A method as claimed in any one of claims 20-26, characterised in that it further comprises the step of applying glue to said opening devices (2) before picking.

28. A method as claimed in any one of claims 20-27, characterised in that it further comprises the step of feeding said packages (3) to said package conveyor (6).